

Potamothrix scleropenis sp. nov. (Oligochaeta: Tubificidae) from Fuxian Lake, the Deepest Lake in Southwest China

Yong-De Cui^{1,2} and Hong-Zhu Wang^{1*}

¹State Key Laboratory of Freshwater Ecology and Biotechnology, Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan 430072, China

²Graduate School of Chinese Academy of Sciences, Beijing 100049, China

ABSTRACT—*Potamothrix scleropenis* sp. nov. (Tubificidae: Tubificinae) is described from the profundal zone (74 m) of Fuxian Lake, the deepest lake (up to 155 m) on the Yunnan-Guizhou Plateau in China. The new species is assigned to *Potamothrix* because of its short vasa deferentia and its tubular atria without ejaculatory ducts and prostate glands. It differs from congeners by its cuticularized penis sheaths; bifurcated, strongly curved spermathecal chaetae; bifurcated lower prongs of bifids; and feathered hairs. *P. scleropenis* appears closely related to *P. cekanovskajae* Finogenova, 1972 and *P. tudoranceai* Šporka, 1994, since all the three species have homogeneous atria without prostate glands.

Key words: *Potamothrix*, profundal Tubificinae, new species, Fuxian Lake, Yunnan Province

INTRODUCTION

Previous studies of freshwater oligochaetes in China have mainly been conducted in the east, whence 28 species and 14 genera of Tubificidae have been recorded so far (Chen, 1940; Liang, 1962, 1979, Erséus and Qi, 1985; Brinkhurst *et al.*, 1990; Liang and Xie, 1997; Wang and Liang, 2001; Wang, 2002). Few taxa were hitherto known from the west.

As the deepest lake on the Yunnan-Guizhou Plateau, Fuxian Lake (24°17'37"N, 102°49'57"E) is located in eastern Yunnan Province and discharges into the upper reaches of the Nanpanjiang River. The lake covers an area of 211 km² at its surface water level of 1721 m ASL, attaining a maximum depth of 155 m and a shoreline development (D_L) of 1.72. Formed in the late Pliocene (3.0–3.4 Ma), this tectonic lake is known to have a unique fauna, in which 12 endemic species have been recorded (Nanjing Institute of Geography and Limnology, 1990; Yang and Chen, 1995). However, no previous taxonomic work has been done on oligochaetes in this lake. The only report of microdriles from the whole province dealt with two aberrant species of branchiobdellidians from Erhai Lake (Liang, 1963).

As the first oligochaete study in Fuxian Lake, this paper describes a single tubificid specimen representing a new, strikingly aberrant species of the genus *Potamothrix* Vejdovský and Mrázek, 1902. Ecological and distributional

data on Oligochaeta from the lake will be published separately.

MATERIALS AND METHODS

From August 2002 to August 2003, a total of 98 sediment samples were taken with a weighted Petersen grab (1/16 m²) from 14 stations in Fuxian Lake. The sediment was cleaned with a 250-µm-mesh sieve. The exposed worms were sorted under a dissecting microscope and preserved in 10% formalin. Altogether more than 200 mature oligochaetes were collected, but most species were represented by one or a few individuals each.

The specimen described herein was first examined in a temporary glycerine mount, then stained with borax carmine and permanently mounted in Canada balsam. Measurements of the body and chaetae were made from the glycerine mount, but the other measurements were made from the permanent mount. Drawings were done with a camera lucida. The holotype is deposited in the Institute of Hydrobiology (IHB), Chinese Academy of Sciences (CAS), Wuhan, China.

TAXONOMY

Potamothrix scleropenis sp. nov.

(Figs. 1–3)

Holotype: IHB YNA 2002018a, whole-mounted specimen.

Type locality: East of Gushan Island (24°24'5"N, 102°52'45"E) in Fuxian Lake, eastern Yunnan Province, China; depth 74 m, bottom temperature 13.7°C, dissolved oxygen in bottom water 5.8 mg/L, total nitrogen in water 0.115 mg/L, total phosphorus in water 0.015 mg/L; fine clay; 8 Oct 2002, coll. Y. Cui & X. Liu.

* Corresponding author. Phone: +86-27-68780719;
Fax : +86-27-68780719;
E-mail: wanghz@ihb.ac.cn

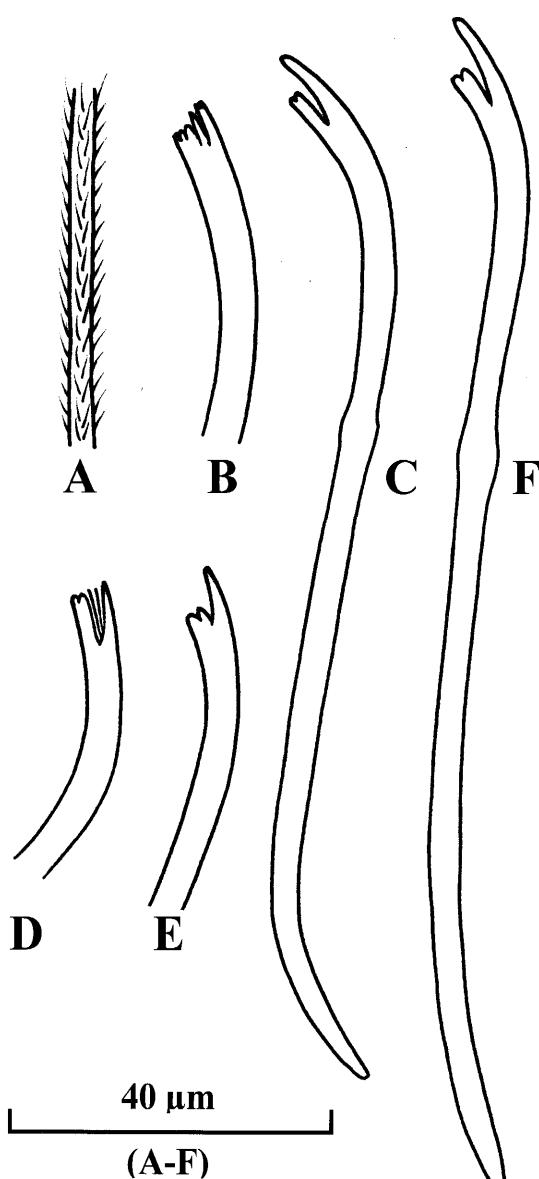


Fig. 1. *Potamothrix scleropenis* sp. nov., chaetae. (A) hair; (B–D) dorsal bifids (V, VII, XIII, respectively); (E–F) ventral chaetae (III, XVII, respectively).

Etymology: The specific name ‘*scleropenis*’ is Greek for ‘hard penis’ and refers to the cuticularized penis sheaths.

Description: Anterior part of specimen remaining, length > 7.2 mm, diameter at XI about 0.9 mm, segments > 22. Clitellum inconspicuous.

Dorsal chaetae (Fig. 1C) of II–V bifid only, 6–9 per bundle, 120–140 μm long, 3.0–4.0 μm thick, with upper prongs blunt, twice as long as, and thicker than truncated, usually secondarily branched lower prongs. From VI onwards, dorsals comprise 3–8 hairs and 3–7 bifids per bundle; hairs (Fig. 1A) feathered, 200–360 μm long, 3.0–4.0 μm thick basally; bifids (Fig. 1B, D) pectinate, 110–124 μm long, 3.2–3.6 μm thick, with (0) 1–2 thin (sometimes thick) intermediate teeth; upper prongs occasionally somewhat bifurcated, slightly longer and conspicuously thinner than usually bifurcated lower prongs, or equally long. Ventral chaetae (Fig.

1E, F) bifid, 6–9 per bundle anteriorly, 2–4 (5) per bundle in postclitellar segments, 100–140 μm long, 3.0–4.0 μm thick, with prongs similar to those of dorsals in II–V. Dorsal chaetae absent from XI. Spermathecal chaetae (Fig. 3A; Fig. 3B, sc) one per ventral bundle in X, entally embedded in muscular sacs (Fig. 3B, scs), about 90 μm long, 3.6 μm thick; shafts strongly curved, with distal ends bifurcated and ectal parts grooved. Penial chaetae (Fig. 2A, pc; Fig. 2C) unmodified, 2–3 per bundle in XI, 76–80 μm long, 2.5–3.0 μm thick, with upper prongs longer and thinner than unbranched lower prongs. Male pores paired in line with ventral chaetae, posterior to middle of XI, immediately anterior to penial chaetae. Spermathecal pores paired in line with ventral chaetae in mid-X, immediately anterior to spermathecal chaetae.

Chloragogen cells from VI onwards. No coelomocytes. Male genitalia (Fig. 2A) paired. Vas deferens (Fig. 2A, vd) 300–320 μm long, 24–36 μm wide, entering atrium apically. Atrium (Fig. 2A, a) 880–920 μm long, 60–110 μm wide, tubular and rather homogeneous throughout (right one somewhat folded in middle), with thin outer muscular layer and thick inner epithelium, and without prostate gland. Soft part of penis (Fig. 2A, p) about 140 μm long, basally 70 μm wide, ectally 24 μm wide, cylindrical and tapering ectally, enclosed in copulatory sac; penis surrounded by cuticularized, somewhat thimble-shaped sheath (Fig. 2A, ps; Fig. 2B), 130 μm long, 30–100 μm wide, with 12–18 μm thick walls, and with edge of ectal opening irregular (Fig. 2B, eo). Copulatory sac (Fig. 2A, cs) 160 μm long, 80–140 μm wide, with outer muscular layer 8–14 μm thick.

Spermathecal ducts (Fig. 3B, sd) 280–320 μm long, 70–140 μm wide, with outer muscular layers 3–4 μm thick; ampullae (Fig. 3B, sa) pear-shaped, 520–600 μm long, 200–480 μm wide. Spermatozeugmata (Fig. 3B, sz) 15–20 in each lumen, about 400–800 μm long.

Distribution and habitat. Known only from type locality, Yunnan, China. Freshwater lake, 74 m depth, <15°C, fine clay.

DISCUSSION

Although we made great efforts to collect oligochaetes in this oligotrophic lake (see Materials and Methods), only one individual of *Potamothrix scleropenis* sp. nov. was found. Since the specimen was fully mature and very characteristic, we describe it as a new species with certainty.

The somewhat thimble-shaped, cuticularized penis sheaths of this new species resemble those of some tubificines, such as *Ilyodrilus* Eisen, 1879. However, the short vasa deferentia, tubular atria without ejaculatory ducts, and lack of prostate glands of the new species fit more closely the definition of *Potamothrix* Vejdovský and Mrázek, 1902 than that of any other described genus.

The genus *Potamothrix*, established by Vejdovský and Mrázek (1902) for *P. moldaviensis* Vejdovský and Mrázek, 1902, was recently revised by Finogenova and Poddubnaja (1990). Eighteen species were previously known in the

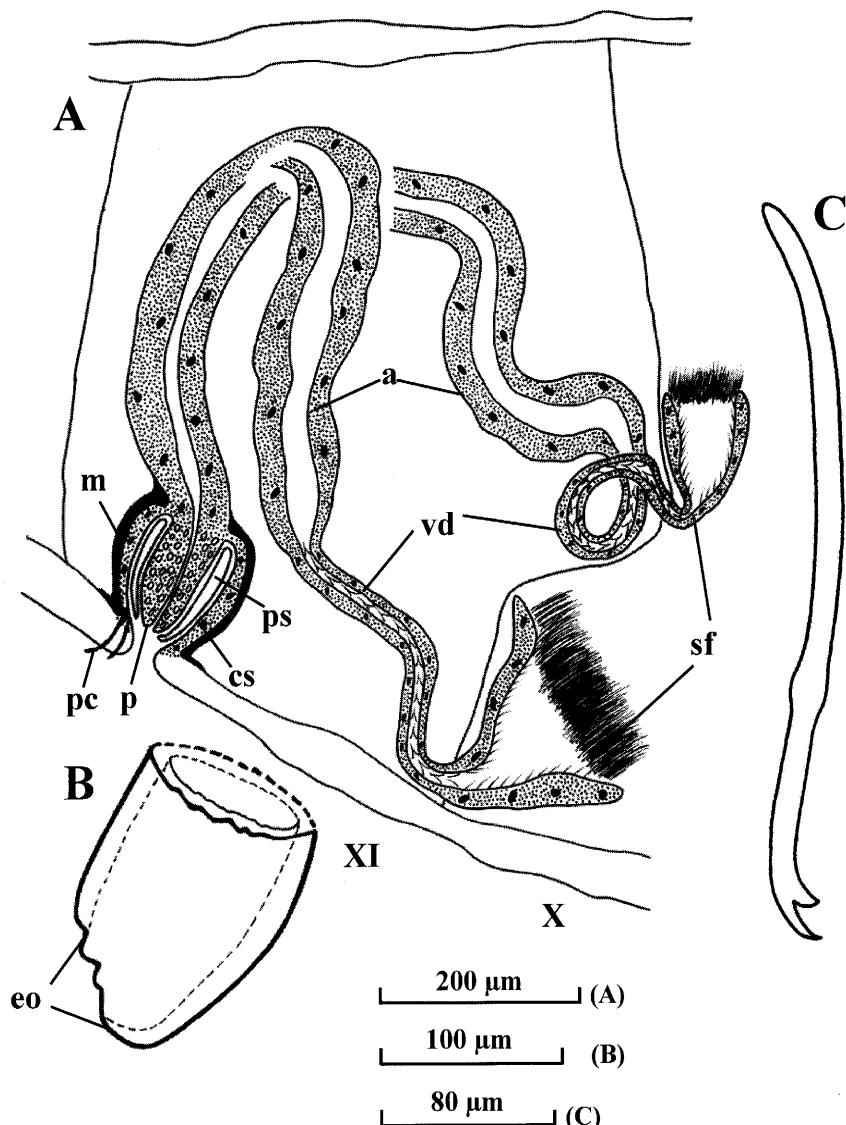


Fig. 2. *Potamothrix scleropenis* sp. nov., male genitalia. (A) lateral view of male ducts in segments X-XI (the right atrium is somewhat folded in the middle); (B) cuticularized penis sheath; (C) penis chaeta. Abbreviations: a, atrium; cs, copulatory sac; eo, ectal opening; m, muscle; p, penis; pc, penial chaeta; ps, penial sheath; sf, sperm funnel; vd, vas deferens.

genus, mainly distributed in the Holarctic region (Brinkhurst and Jamieson, 1971; Hrabe, 1981; Brinkhurst and Wetzel, 1984; Finogenova and Poddubnaja, 1990; Šporka, 1994; Milbrink, 1999; Milbrink and Timm, 2001).

Potamothrix scleropenis sp. nov. is easily distinguished from congeners in having 1) cuticularized penis sheaths, 2) bifurcated, strongly curved spermathecal chaetae, 3) usually bifurcated lower prongs of bifids, and 4) feathered hairs. That the hairs and pectinate bifids begin from segment VI could also be a feature, but this needs further confirmation from more specimens.

Potamothrix scleropenis appears closely related to *P. cekanovskajae* Finogenova, 1972 from Caspian Sea (Finogenova and Poddubnaja, 1990) and *P. tudorancea* Šporka, 1994 from Ethiopia (Šporka, 1994) in that all three species have homogeneous atria without prostate glands. Nevertheless, the length of the atria of the new species is only 1/4-1/3 of the length of the atria of the other two species, while

the vasa deferentia are 3-4 times as long as the corresponding structure in the others. With regard to the short atria (<1000 µm), the new species shows some affinity to *Potamothrix bavaricus* (Oschmann, 1913). However, in *P. scleropenis*, the length ratio of vasa deferentia to atria is 1:3, and the atria are homogenous; in *P. bavaricus* the ratio is 1:8 to 1:9, and the atria are tripartite (Timm, 1970; Finogenova and Poddubnaja, 1990).

This is the second species of *Potamothrix* recorded from China. The first, *P. bedoti* (Piguet, 1913), was reported from a shallow lake in Wuhan by Wang and Liang (2001).

ACKNOWLEDGMENTS

We are indebted to Messrs Xueqin Liu, Jianhui Qin, and Sixin Li (Institute of Hydrobiology, Chinese Academy of Sciences) for their kind assistance with the fieldwork, and to Dr Emilia Rota (Università di Siena, Siena, Italy) for etymological advice. Financial sup-

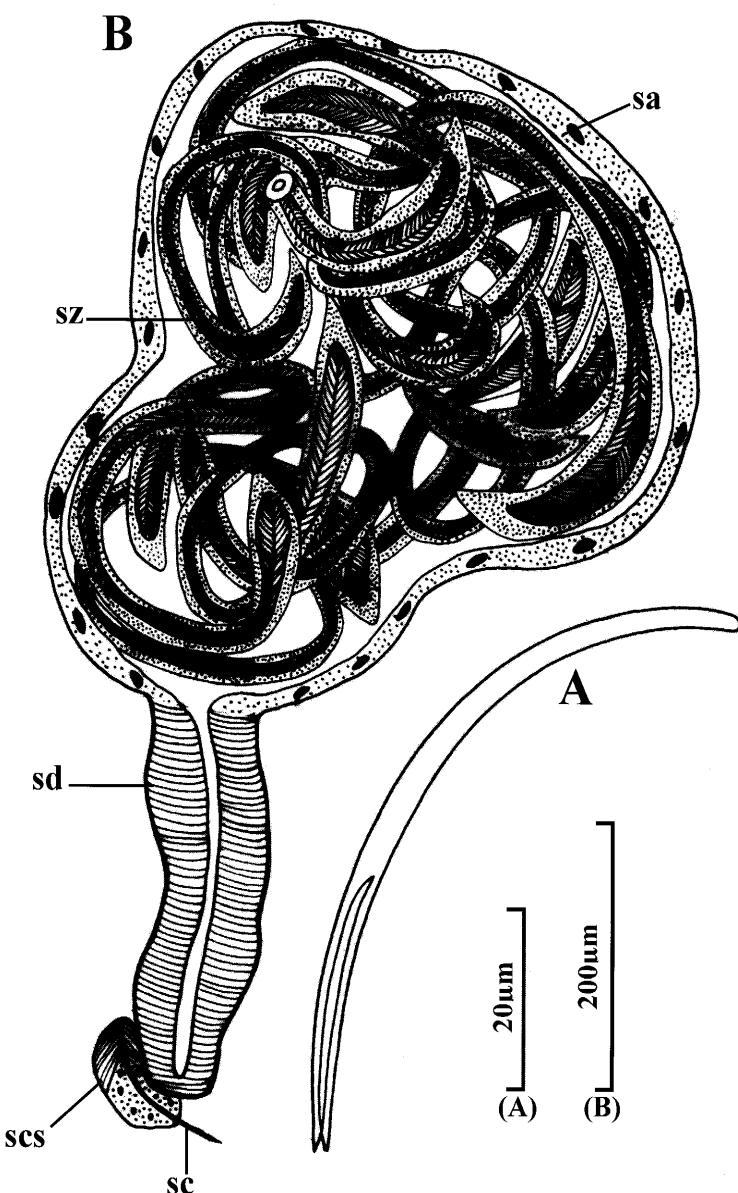


Fig. 3. *Potamothrix scleropenis* sp. nov. (A) spermathecal chaeta; (B) spermatheca. Abbreviations: scs, spermathecal chaeta sac; sa, spermathecal ampulla; sc, spermathecal chaeta; sd, spermathecal duct; sz, spermatozeugma.

port was provided by a CAS Key Project grant (KSCX1-SW-13-04) and the National Natural Science Foundation of China (No. 30470205).

REFERENCES

Brinkhurst RO, Jamieson BGM (1971) Aquatic Oligochaeta of the World. Oliver and Boyd, Edinburgh

Brinkhurst RO, Qi S, Liang YL (1990) The aquatic Oligochaeta from the People's Republic of China. Can J Zool 68: 901–916

Brinkhurst RO, Wetzel MJ (1984) Aquatic Oligochaeta of the World: supplement. A catalogue of New Freshwater Species, Description, and Revisions. Can Tech Rep Hydrogr Ocean Sci 44: 1–101

Chen Y (1940) Taxonomy and faunal relations of the limnetic Oligochaeta of China. Contr Biol Lab Sci Soc China Zool 14: 1–132

Erséus C, Qi S (1985) Two aberrant Tubificidae (Oligochaeta) from Pearl River in the People's Republic of China. Hydrobiologia 127: 193–196

Finogenova NP, Poddubnaja TL (1990) One more revision of the genus *Potamothrix* Vejdovský et Mrázek, 1902 (Oligochaeta, Tubificidae). Zool Jb Syst 117: 55–83

Hrabe S (1981) The freshwater Oligochaeta (Annelida) of Czechoslovakia. Acta Univer Carolin Biolog 1979: 1–167

Liang YL (1962) On some naids and tubificids from north-eastern China. Acta Hydrobiol Sin 2: 14–26

Liang YL (1963) Studies on the aquatic Oligochaeta of China. I. Descriptions of new naids and branchiobdellids. Acta Zool Sin 15: 560–570

Liang YL (1979) Studies on the aquatic Oligochaeta of China. III. Aquatic Oligochaeta of the Huama Lake. Oceanol Limnol Sin 10: 273–281

Liang YL, Xie ZC (1997) Aquatic Oligochaeta from Wuling Mountains area. In "Invertebrates of Wuling Mountains area, South-western China" Ed by DX Song, Science Press, Beijing, pp 383–394

Milbrink G (1999) Distribution and dispersal capacity of the Ponto-Caspian tubificid oligochaete *Potamothrix heuscheri* (Breitscher, 1900) in Scandinavia. Hydrobiologia 406: 133–142

Milbrink G, Timm T (2001) Distribution and dispersal capacity of the Ponto-Caspian tubificid oligochaete *Potamothrix moldaviensis* Vejdovský et Mrázek, 1903 in the Baltic Sea Region. Hydrobio-

logia 463: 93–102
Nanjing Institute of Geography and Limnology (CAS) (1990) The
Fuxian Lake. China Ocean Press, Beijing
Šporka F (1994) *Potamothrix tudoranceai* sp. n., a new species of
Tubificidae (Oligochaeta) from the Ethiopian Rift Valley Lake
Zwai (Africa). Biologia Bratislava 49: 161–165
Timm T (1970) On the fauna of the Estonian Oligochaeta. Pedobio-
logia 10: 52–78
Vejdovský F, Mrázek A (1902) Ueber *Potamothrix (Clitellio?) molda-*
viensis n. g., n. sp. Sber K Böhm Ges Wiss Prag 24: 1
Wang HZ (2002) Studies on taxonomy, distribution and ecology of
microdrile oligochaetes of China, with description of two new
species from the vicinity of the Great Wall Station of China, Ant-
arctica. Higher Education Press, Beijing

Wang HZ, Liang YL (2001) A preliminary study of oligochaetes in
Poyang Lake, the largest freshwater lake of China, and its
vicinity, with description of a new species of *Limnodrilus*.
Hydrobiologia 463: 29–38
Yang JX, Chen YR (1995) The biology and resource utilization of
the fishes of Fuxian Lake, Yunnan. Yunnan Science and Tech-
nology Press, Kunming

(Received August 10, 2005 / Accepted September 29, 2005)